

TECHNOLOGY DEPT.

COMMUNICATIONS

Of The Association For

COMPUTING MACHINERY

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COMMUNICATIONS OF THE ASSOCIATION FOR COMPUTING MACHINERY

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By arrangement with the office of Naval Research, U. S. Navy Dept., the Digital Computer Newsletter issued quarterly by that organization is reprinted in its entirety as a supplement to the Communications.

TECHNIQUES DEPARTMENT

NEWS

CEIR (The Council for Economic and Industry Research) has announced a program for their 704 which simulates the operation of a 650 and accepts source programs in 650 machine language. This system is described in a brochure which was distributed at the Eastern Joint Computer Conference in Washington, D. C. This should be of interest to many since it can serve to alleviate a temporary overload of 650 facilities, run programs with excessive storage requirements or act in many ways as a buffer for various emergency conditions. The full instruction repertoire is accepted and it is asserted that (on the basis of rental costs for both machines) the cost per answer when run on the simulator is at least as low as when run on a 650. Many cases have been run where the 650 program has been patched to use 704 library subroutines, greatly increasing computing speeds. At the present this program is the exclusive property of CEIR, and further information may be obtained by writing them at 1200 Jefferson Davis Highway, Arlington 2, Virginia.

The advent of this system prompted this department to make a short survey of systems which accept the machine language program of another computer and simulate the running of that program. The chart on page 4 contains all of the information it has been possible to gather from limited sources and further information is solicited from readers. From all appearances, most of these simulators will never be overpopular.

VARIABLE-WIDTH TABLES WITH BINARY-SEARCH FACILITY

MARK HALPERN, IBM Corporation

The family of subroutines described in this report was designed to create, search and maintain tables which are to contain entries of different lengths, and yet be amenable to search by partition, or "binary" search. It is designed explicitly for fixed-word-length binary machines; the tables in question are the argument-function type, with the two parts physically separated—i.e., no one machine word contains both, or parts of both. The family consists at present of seven subroutines, of which four are primitive and three second-generation. (By "primitive" is meant a self-sufficient routine; a second-generation routine is one which calls on one or more primitives.) These routines are at present coded for the IBM 709; with a few trivial changes they are ready also for the 704. The primitives are: (1) STT (Start Table), (2) TLU (Table Look-Up), (3) ITC (Increase Table Capacity), and (4) AOD (Append Ordered Data). The second-generation routines are: (1) INT (Insert in Table), (2) INX (Insert and Expand), and (3) ANX (Append and Expand). It is intended that this family be written, with modifications as necessary, for several stored-program computers. The calling-sequences for any one of the routines will, as far as possible, be identical on the several machines.

The tables dealt with by this family are organized in the form of matrices, or series of sub-tables, as shown in Figure 1.

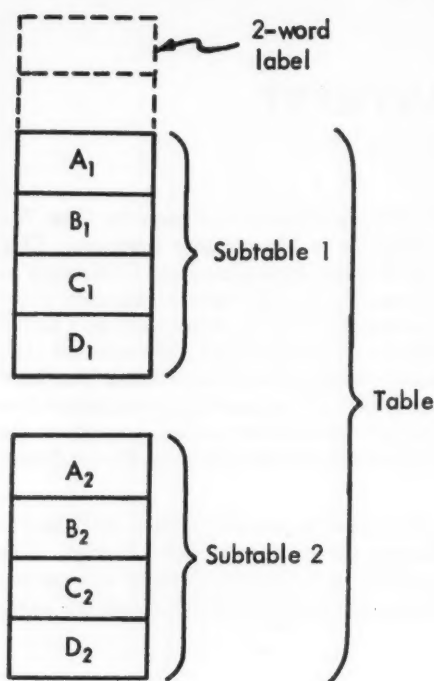


FIGURE 1

Figure 1 shows a table in which 4 entries have been made: A, B, C and D. Each is too long to fit into a single word, and has accordingly been divided in two. The first parts, A_1 , B_1 , C_1 and D_1 , have been collected and stored in subtable 1; the second parts, A_2 , B_2 , C_2 and D_2 , in subtable 2. The order of entries in subtable 1 is determined by the values of the whole entries A, B, C and D; the order in subtable 2 is determined solely by the locations in subtable 1 of the high-order parts of these entry-segments. Only subtable 1 entries, then, will necessarily exhibit monotonic increase or decrease in value. There may be as many such subtables as are required, and all succeeding subtables will be ordered as was subtable 2. If A, B, C and D are not of equal length, these rules hold: (a) the number of subtables required is that required by the longest entry, and (b) trailing zero's will be attached to shorter entries to bring them up to the length of the longest.

When this table is to be searched, the first word's worth of the comparand (the value for which the table is being searched) is isolated, and a binary search of subtable 1 is made until either a match is found, or one of several special conditions, to be discussed below, is detected. Assume a match found at the Nth location of subtable 1, which we will call the base-point. The second word's worth of the comparand is then matched against the Nth word of subtable 2. If there are more than two subtables, the process is continued, successive words' worth of the comparand being matched against the Nth

locations of successive subtables. If matches are obtained straight through to the end, the search has been successfully completed. If at any stage after the fixing of a base-point a match is not obtained, a new base-point is defined, equal to the old base-point plus or minus one. (The new base-point will be higher or lower as the no-match condition dictates.) If the value at the new base-point is equal to that of the first word's worth of the comparand, the process of attempting matches between successive words' worth of the comparand and Nth entries (N now being the ordinal number of the new base-point) of successive subtables may proceed. This process may be repeated as often as no-match conditions require, provided only that the new base-point required by the no-match condition is equal in value to the first word's worth of the comparand.

This process must eventually end in one of two ways: the finding of an entry which matches the comparand word-for-word, or the finding of a pair of adjacent entries which bound the value of the comparand. This pair of values may be used for interpolation if the function is continuous, or, if the function is discrete, simply as an indication that the comparand has no equivalent in the table. The possibility that the value of the comparand lies outside the upper or lower bound of the table is eliminated at the outset by attempting a preliminary match between the comparand and the least and greatest argument in the table. This technique has proven to be highly economical of time. Comparands falling outside the table can be detected and reported on before even the initialization for the subroutine has been completed.

Assuming the comparand matched perfectly with some argument in the table, the function may then be obtained in either of two ways. If the number of sub-tables required by the arguments is Y, then a $(Y+1)$ th sub-table will contain either the first words of the functions associated with the arguments stored above, or simply a series of addresses giving the locations of the functions. If the first method is adopted, then functions longer than one word may be broken up and stored in successive sub-tables just

as the arguments were. Table-searching will involve only the first Y sub-tables, of course; table modification will involve Y+Z, where Z is the number of sub-tables required to store the functions or their addresses.

The sub-tables, as indicated in Figure 1, are not necessarily contiguous. Let the number of words per sub-table be N, and the number of words between Nth entries of adjacent sub-tables be Δ ; then

$\Delta \geq N$. (See Figure 2). Delta is a programmer-supplied parameter, and may be used to exert various kinds of control over table operations. If, for example, the programmer wishes to ensure that the table not exceed a certain size, Q, he can do so by setting

$$\Delta = \frac{Q - 2}{Y + Z},$$

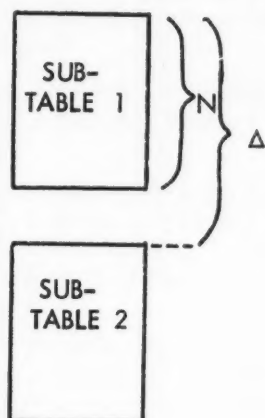


FIGURE 2

and using subroutine INT to add entries to the table. This subroutine compares N against Δ before adding new entries, and transfers to an error-return if an attempt is made to add entries when $N = \Delta$. This technique also optimizes on time, since a pre-set constant Δ , combined with subroutine INT, means that the sub-tables are not to be moved further apart.

Where the programmer does not know how many entries to expect, or where space rather than time is to be optimized on, Δ should be set to a value no greater than the minimum number of entries expected (if no estimate of this number can be made, set $\Delta = 1$), and subroutine INX (Insert and Expand) must be used. This subroutine, on finding that

$N = \Delta$, increases Δ by spacing the sub-tables out to intervals equal to the number of entries to be added. The parameters for INX include an absolute limit to expansion, enabling the programmer to ensure that the table cannot grow to the point where it begins to wipe out wanted information.

Where the entries to be added consist of arguments which are (a) all greater in value than the highest currently stored in the table, and (b) ordered among themselves, the subroutines to use are AOD (Append Ordered Data) instead of INT, and ANX (Append and Expand) instead of INX. These Append subroutines, as their names imply, simply attach the new entries to the bottom of the sub-tables, skipping the space-and-time-consuming look-ups which are necessary for inserting entries of unknown value.

The family of subroutines which has been described is not complete: new members being worked on will provide for automatic interpolation, both linear and parabolic and for the deletion of unwanted entries from the table.

COMPUTER BEING SIMULATED	COMPUTER ON WHICH SIMULATOR IS RUN		Real-time ¹ Speed ratio	LIMITATIONS	PRODUCED BY	Date Complete
650	All models	704	8096 word memory, 6 tape units, off-line equipment	5-8 1 —TO—	Council for Industry and Economic Research, 1200 Jefferson Davis Highway, Arlington 2, Virginia	Fall 1957
709	2500 or 6500 words in tapes	704	4K or 8K memory in tapes	1	IBM Applied Programming at Mass. Inst. of Technology	Spring 1958
704		701	4096 word memory	1	United Aircraft Corp., Hartford	Spring 1955
704		701	2048 word memory Drum	1	RAND Corp., contributed at third SHARE meeting	Fall 1955
650	2000 word drum read-punch unit	701		1	Chance-Vought Aircraft	
650	2000 word drum read-punch unit	705	20,000 char. mem. on-line rdr, punch	1	Standard Oil of Indiana. Available as IBM Form 32-7763	Spring 1957
705	TCU	705	TRC 20K or 40K memory	1	IBM Applied Programming (to be replaced by auto-conversion prog.)	Fall 1957
702	10K or 20K mem.	705	20K or 40K memory	1	IBM Applied Programming (See 705 Bulletin No. 6)	Spring 1957
705	20K or 40K mem.	702	10K memory Drum	1	IBM Applied Programming (See 705 Bulletin No. 6)	Summer 1955
650	Core mem., drum, indexing, flt. point	650	2000 word drum read-punch unit	1	IBM-650 Library No. 2.0.011 (Fiasco)	
650		Datatron 205		1		
Univac II	2000 word memory	Univac I	1000 word memory	1	Remington-Rand. 2 versions, by Philadelphia and New York offices.	Winter 1956
1103		Univac I		1		

COMPUTER SIMULATION SYSTEMS—MACHINE LANGUAGE

¹With respect to running of computer being simulated

²When program is mostly floating point arithmetic

OFFICIAL NOTICES

The thirteenth annual meeting of the Association for Computing Machinery will be held at the University of Illinois, Urbana, Illinois, on the 11th, 12th, and 13th of June.

Contributed papers are invited. It has been the policy to allow 15 minutes for presentation and 5 minutes for discussion of these papers. Authors desiring to submit contributed papers should send *four* copies of:

1. An abstract of not more than 200 words.
2. A three page summary (not including proofs) of the principal results and their applications.

to:

Professor Jim Douglas, Jr.
Department of Mathematics
Rice Institute
Houston, Texas

by:

March 3, 1958

The abstracts of accepted papers will appear in the program of the meeting, and the summaries will appear as preprints. These preprints will be distributed at the time of the meeting and *at no other time*.

Approximately 2000 copies of "New Computers—A Report from the Manufacturers," the proceedings of the one-day technical symposium sponsored by the Los Angeles Chapter of the Association for Computing Machinery on March 1, 1957, are now available. The contents include:

Opening Remarks

Walter F. Bauer, The Ramo-Wooldridge Corporation

Magnetic Tape File Processing with the NCR 304

J. S. Sumner, The National Cash Register Company

The Cardatron and the Datafile in the Datatron System

Frederic G. Withington, ElectroData Div., Burroughs Corporation

A New Large-Scale Data Handling System Datamatic 1000

W. C. Carter, DATAmatic Corporation

Bizmac II Computer, Characteristics and Applications

A. S. Kranzley, et al., Radio Corporation of America

The X308 Computer

E. D. Zimmer, Remington Rand Univac

The IBM 709 Computer

J. L. Greenstadt, International Business Machines Corporation

Design Objectives for the IBM Stretch Computer

W. Buchholz, International Business Machines Corporation

Philco S-2000 Transistorized Large-Scale Data Processing System

S. Y. Wong, Philco Corporation

The Alwac Corporation Model 800 Computer

Niel Block, The Alwac Corporation

Closing Remarks

John W. Carr, III, University of Michigan

Copies will be distributed at \$2.50 each in response to orders received by the Association for Computing Machinery, 2 East 63 Street, New York 21, New York.

NEWS AND NOTICES

National ACM Activities

A proposed amendment to the ACM constitution is now being drafted to provide for the election of the Chairman of the Editorial Board by the Council and to make him a full voting member.

Mr. Ezra Glaser was appointed to investigate a proposal that a class of student membership be established in the Association. He will investigate the practice of other professional organizations and will communicate his findings to the Council through the Secretary.

Dr. A. S. Householder reported on the International Meeting on Data Processing which will be held in 1959 in Paris, probably in the fall or early summer. The meeting will be sponsored by UNESCO, with technical representatives as an Advisory Committee to UNESCO. It is thought that a total budget of \$75,000 will be needed of which UNESCO will advance \$25,000. Mr. A. Auerbach will attend an organizational meeting in Paris soon, as the JCC Representative. The Council encouraged an emphasis at the planning meeting that the program committees should consist of representatives from professional societies rather than of the governments in UNESCO. Dr. Householder reported that plans to date call for the programming committee to be composed of technical people, but that the committees will have advisory authority at most. The countries that can participate in the conference must be members of UNESCO, but not necessarily of the United Nations.

An invitation extended by the Institute of Mathematical Statistics has been accepted by ACM to co-sponsor a meeting with that organization to be held April 2-4, 1959 at the Case Institute of Technology in Cleveland. Dr. Daniel Teichroew, Statistics Member-at-Large, will act as liaison with the IMS group. Professor James Douglas, Program Chairman, will carry out responsibility for the program. Mr. Martin B. Wilk of the Bell Telephone Laboratories at Murray Hill, New Jersey, will be IMS Program Coordinator.

The ACM Council has been informed of a proposed formation of a "Mathematics Conference Organization." Organizations which might be affiliated include the American Mathematical Society, the Institute of Mathematical Statistics, the Association for Symbolic Logic, the Mathematical Association of America, the National Council of Teachers of Mathematics, and the Society for Industrial and Applied Mathematics.

A letter was received from N. L. Franken, Secretary of the Digital Electronic Computer Society of South Africa (P. O. Box 7018, Johannesburg) requesting Institutional Membership in ACM and discussing contacts with our European Section. Excerpts from the letter are as follows:

"It seems that our aims and objects are similar to those of your Association, be it then, that we do not include amongst our members those interested in the design and construction of computers. They will feel more at home in a society for electronic instrumentation, and we understand that such a society will be formed in South Africa in the very near future."

"... we inform you that our aims are to form an organization for those actively engaged in the introduction of a computer into the clerical field, and to create for them the possibility to 'pool' their knowledge. This should ultimately, of course, result in the arranging of conferences and lectures and the publication of a journal. The foundation members number, in total, 15, and as soon as our Society has been registered in terms of the Company's Act, we will be able to enroll members. We expect this membership to grow very fast during the next few months until a total of about 200 will have been reached. You will understand that those engaged in this field in South Africa will be considerably smaller in number than in the United Kingdom or the U. S. A. The Executive Council of our Society was formed as follows: J. Apsinall, President, D. A. Rock, Vice President, N. L. Franken, Secretary/Treasurer (Alternate A. P. Gibson), E. Postage, Member."

"We shall be grateful if you will make the forming of this South African Society known to your members, and we are sure that the bond thus created will ultimately prove to the mutual benefit of all engaged in the field of the application of electronic computers."

Dr. Paul Brock of the Willow Run Laboratories, University of Michigan, now on "detached service" in Monterey, California, is now Chairman of the ACM Education Committee.

Mr. D. H. Brown at the New York Academy of Sciences in New York City has taken over the ACM secretarial duties of Mr. William Giese.

Franz Verzuh has been appointed as ACM representative to the 1958 Eastern Joint Computer Conference in Boston in December.

ACM Chapter News

Houston Chapter:

At the November-December meeting, approximately 40 people heard Dr. Martin Graham of the Electrical Engineering Department at Rice Institute describe the Rice Computer, a modified version of the MANIAC II, now under construction.

The program announced for the January 29 dinner meeting included election of officers and a talk by Dr. Albert Newhouse of the University of Houston Research Department on "Curve and Surface Fitting."

Pittsburgh Chapter:

Chairman Frank Engel reports that the Pittsburgh Chapter is holding three-hour Saturday morning classes in programming for selected high school students. Carnegie Institute of Technology and the University of Pittsburgh are furnishing machine time on their IBM 650's.

The program for the January 22 Chapter meeting was a panel discussion of Fortran with Hal Stern of IBM's New York office and Professor A. J. Perlis of Carnegie Institute of Technology presiding.

It is interesting to note that the Pittsburgh Chapter evolved from evening gatherings of approximately a dozen men at the homes of E. B. Weinberger and Frank Engel. Official status as an ACM Chapter was established in late 1955 and approximately 50 people now attend the meetings.

Los Angeles Chapter:

"Simulation is our Business," a discussion of the use of analog and digital differential analyzers in process simulation and control, was the subject of the two speakers at the January 8 dinner meeting of the Los Angeles ACM Chapter. Mr. William Kindle, Director of the Computation Center of Electronic Associates in El Segundo spoke on "Amplifiers Unlimited" and Mr. Geoffrey Post, Project Engineer in Digital Systems for Litton Industries in Beverly Hills told everyone to "Do it with Digits." It was interesting that only three of the approximately 60 people attending the meeting were actually engaged in work with differential analyzers rather than general purpose digital computers.

Each month the Chapter publishes a newsletter, the DATA-LINK, usually about five pages long. Frank Wagner and Jeanette Orgill of North American Aviation deserve the compliments for this activity.

The February 5 meeting will have an unusual subject as the program topic—"Computers at the Race Track." Mr. Oscar C. Levy, Vice President of American Totalisator Company, will describe the problems and experiences involved in the application of a Burroughs E-101 for computation of track odds and payoffs at Santa Anita Race Track in Arcadia, California last season.

Syracuse Chapter:

Individuals from Syracuse University and representatives from various industries in the Syracuse area (Solvay Process, Sylvania, General Electric, Niagara Mohawk, Crouse-Hinds, Carrier, IBM and Remington Rand) worked together to establish the Syracuse Chapter of ACM which gained official status in April 1957. Chapter officers for 1957 were, Chairman, Dr. Bruce Gilchrist; Vice Chairman, John Van Der Weele; Secretary-Treasurer, Robert Jones. Election of officers for 1958 is on the agenda for the January 31 meeting. The initial membership of 18 has increased to 41 at present.

The Chapter has joined with 26 other local and national technical and engineering societies to organize the "Technical Societies Council of Greater Syracuse." The Council's purposes are "to further the public welfare wherever technical and engineering knowledge and experience are involved, to promote cooperation among technical and engineering societies of Central New York, and to consider and act

upon matters of mutual concern to the engineering and allied technical professions." In 1957 five ACM members offered their services as advisors to local high schools in organizing forum meetings, science congresses and career guidance.

Regular monthly meetings have covered such topics as "Modern Developments in Computers and Applications," "The Electronic Computer as a Management Tool," "Personnel Requirements of the Computer Age," "Computer-Taught Lessons," "Mechanized Inventory Control," "Univac Scientific," "SAGE," "The Datatron 205," and "Automatic Programming." At the next meeting, to be held on January 21, Dr. George P. Cressman, Director of the U. S. Weather Bureau's Joint Numerical Weather Prediction Unit, will discuss the use of an electronic computer in making weather predictions.

San Diego Chapter:

The January Chapter meeting was addressed by Dr. Charles Monk, an oceanographer from Scripps Institute. By use of computing machines, Dr. Monk analyzes and correlates the tremendous amounts of data gathered in his research on spectral analysis of ocean wave motions. His applications of mathematical spectral analysis are based chiefly on the work of Dr. Tukey at Princeton and are practical only with the use of modern computing machinery.

The Chapter's regular monthly four-page Newsletter is evoking much interest.

New San Diego Chapter members are Ruck Byrnes, Programmer, Astronautics Digital Computing Group; Dr. M. H. Halstead, Head, Research Theory and Analysis Branch, NEL; Donald M. Lowe, Head, Analog Computer Subsection and Digital Computer Programming, NEL; R. W. Rempel, Mathematician, NEL; Alfred H. Schainblatt, Dynamics Engineer, Convair.

Coming Events

Research Session on Information Processing at the AIEE Winter Meeting

February 6, 1958; Hotel Statler, New York City, New York

High-Speed Computer Conference, 1958

February 11-14, 1958; Louisiana State University, Baton Rouge, La.

Sponsor: Louisiana State University through the General Extension Division

Contact: J. W. Brouillette, Director, General Extension Division, Louisiana State University, Baton Rouge, La.

Industrial Relations Conference

February 20-24, 1958; Town and Country Hotel, San Diego, California

Sponsor: EIA

American Mathematical Society Meeting

February 22, 1958; New York City, New York

SHARE Meeting

February 26-28, 1958; Mayflower Hotel, Washington, D. C.

Contact: Frank Wagner, North American Aviation, Los Angeles 45, Calif.

American Management Association Electronics Conference, and EDP Equipment Exhibit

March 3-5, 1958; Statler Hotel, New York City, New York

Contact: AMA, Inc., 1515 Broadway, Times Square, New York 36, New York

Nuclear Congress

March 17-21, 1958; International Amphitheater, Chicago, Ill.

IRE National Convention

March 24-27, 1958; New York Coliseum and Waldorf-Astoria Hotel, New York City, New York

USE Meeting

March 26-28, 1958; Washington, D. C.

Tenth Annual New Jersey Symposium on Control Systems Engineering

April 1, 1958; Newark, New Jersey

Symposium on Electronic Waveguides

April 8-10, 1958; Auditorium, Engineering Societies Bldg., New York City, New York
 Sponsor: Polytechnic Institute of Brooklyn in cooperation with IRE Professional Group on Electron
 Devices and the Professional Group on Microwave Theory Techniques
 Co-Sponsors: Department of Defense Research Agencies.

American Mathematical Society Meetings
 April 18-19, 1958; Chicago, Illinois
 April 18-19, 1958; Stanford, California

Conference on Functional Approximations
 April 21-23, 1958; University of Wisconsin, Madison, Wisconsin
 Contact: Dr. A. S. Householder, Oak Ridge National Laboratories

1958 Electronic Components Conference
 April 22-24, 1958; Ambassador Hotel, Los Angeles, California

American Mathematical Society Meeting
 April 25-26, 1958; New York City, New York

Fourth National Flight Test Symposium
 May 4-7, 1958; Park Sheraton Hotel, New York City, New York
 Sponsor: ISA

National Symposium on Microwave Theory and Techniques
 May 5-7, 1958; Stanford University, Stanford, California

Western Joint Computer Conference—"Contrasts in Computers"
 May 6-8, 1958; Ambassador Hotel, Los Angeles, California
 Contact: Dr. Willis Ware, The RAND Corporation, Santa Monica, California

**Los Angeles Chapter ACM Symposium "Small Automatic Computers and Input-Output Equipment—
 A Report from the Manufacturers"**
 May 9, 1958 (the day following WJCC); Ambassador Hotel, Los Angeles, Calif.
 Contact: P. Armer, The RAND Corporation, Santa Monica, California

1958 National Telemetering Conference
 June 2-4, 1958; Lord Baltimore Hotel, Baltimore, Maryland
 Sponsors: ISA, IAS, AIEE

Fourth International Automation Exposition and Congress
 June 9-13, 1958; Coliseum, New York City, New York

1958 ACM National Conference
 Summer, 1958; University of Illinois, Urbana, Illinois

American Mathematical Society Meeting
 June 20, 1958; Corvallis, Oregon

WESCON
 August 19-22, 1958; Ambassador Hotel and Pan Pacific Auditorium, Los Angeles, California

American Mathematical Society—63rd Summer Meeting
 August 25-30, 1958; Cambridge, Massachusetts

The Mathematical Association of America—39th Summer Meeting
 August 25-28, 1958; Cambridge, Massachusetts

SHARE Meeting
 September 10-12, 1958; San Francisco, California

1958 National Simulation Conference
 October 23-25, 1958; Statler-Hilton Hotel, Dallas, Texas
 Sponsors: IRE-PGEC and Dallas Section of IRE
 Contact: Louis B. Wadel, 3905 Centenary Drive, Dallas 25, Texas

American Mathematical Society Meeting
 November, 1958; Evanston, Illinois

Eastern Joint Computer Conference
 December 1958; Boston, Massachusetts

American Mathematical Society—65th Annual Meeting

January 20-22, 1959; Philadelphia, Pennsylvania

Joint Meeting of Institute of Mathematical Statistics (Central Region) and the Association for Computing Machinery

April 2-4, 1959; Case Institute of Technology, Cleveland, Ohio

Contact for IMS: Martin B. Wilk, Bell Telephone Lab., Murray Hill, New Jersey

Contact for ACM: Daniel Teichroew, National Cash Register, Dayton 9, Ohio

1959 ACM National Conference

Summer, 1959; Massachusetts Institute of Technology, Cambridge, Mass.

Contact: F. Verzuh, MIT

Last Minute Calendar Addition

Symposium on Recent Advancements in Programming Methods

March 29, 1958; Ohio State University at Columbus, Ohio

Sponsor: Central Ohio Association for Computing Machinery

Contact: Benjamin Schwartz, Battelle Memorial Institute, Columbus, Ohio

University Activities

This is the first of a series of lists we will print when the information becomes available. The purpose of this list of university computer installations is to facilitate communications between universities with common problems. Of course, the use of common language compilers will eventually make the kind of equipment one has relatively unimportant, but it is felt that this information will be of some use.

The following information was furnished by IBM dated November 13, 1957. Any additions or corrections will be appreciated and noted in subsequent issues. The following installations have IBM 650 computers:

<i>Installation</i>	<i>Location</i>	<i>Director</i>
Boston University	Boston, Mass.	Mr. John E. Alman
Carnegie Inst. of Tech.	Pittsburgh, Penn.	Dr. A. J. Perlis
Case Inst. of Tech.	Cleveland, Ohio	Dr. R. Nelson
Cornell University	Ithaca, New York	Mr. R. C. Lesser
Georgia Inst. of Tech.	Atlanta, Georgia	Dr. E. K. Ritter
University of Houston	Houston, Texas	Dr. E. I. Organick
Indiana University	Bloomington, Indiana	Dr. M. H. Wrubel
M. I. T.	Cambridge, Mass.	Dr. F. M. Verzuh
University of Michigan	Ann Arbor, Michigan	Professor C. C. Craig
N. C. State College	Raleigh, N. Carolina	Dr. Gertrude Cox
Ohio State University	Columbus 10, Ohio	Dr. Ray F. Reeves
Oklahoma State University	Stillwater, Oklahoma	Professor J. Hamblen
University of Pittsburgh	Pittsburgh, Penn.	Dr. D. G. Schindler
University of Rochester	Rochester, New York	Dr. T. A. Keenan
Stanford University	Stanford, California	Dr. G. J. Lieberman
Texas A & M College	College Sta., Texas	
Washington University	St. Louis, Missouri	Dr. D. J. Kaufman
University of Washington	Seattle, Washington	Dr. C. B. Allendoerfer
Wayne University	Detroit, Michigan	Dr. A. W. Jacobson
University of Wisconsin	Madison, Wisconsin	Dr. P. C. Hammer
Iowa State College	Ames, Iowa	Dr. T. A. Bancroft
University of Kansas	Lawrence, Kansas	Dr. U. Hochenstrosser
Northwestern University	Evanston, Illinois	

New York University
University of Florida
University of Oklahoma
VPI

New York, New York
Gainesville, Florida
Norman, Oklahoma
Blacksburgh, Virginia

Dr. W. Viavant

The following have IBM 650 computers on order:

University of Kentucky
University of Cincinnati
Duke University
Illinois Inst. of Tech.
Southern Illinois University
RPI
Florida State University
Kansas State College
Marquette University
Miami University

Lexington, Kentucky
Cincinnati, Ohio
Durham, N. Carolina
Chicago, Illinois
Carbondale, Illinois
Philadelphia, Pa.
Tallahassee, Florida
Manhattan, Kansas
Milwaukee, Wisconsin
Oxford, Ohio

Dr. J. C. Eaves

Dr. Sanger

The Institute of Mathematical Sciences at New York University offers a temporary membership program to aid mathematicians and scientists holding the Ph.D. degree who intend to study and do research in fields such as mathematical physics, functional analysis, numerical analysis and digital computing, etc. The program, supported by the National Science Foundation and by funds contributed by industrial firms, provides a renewable one-year membership; participation in research projects, research seminars and advanced graduate courses; the opportunity of using the IBM 704 and Univac computers; and a small stipend commensurate with the applicant's status. Requests for information should be addressed to Membership Committee, Institute of Mathematical Sciences, 25 Waverly Place, New York 13, New York.

An exchange of translations of Russian papers in the field of digital computers, numerical analysis, automatic programming, and language translation has been organized informally by the Midwest University Computer Users Group. So far reproductions of a number of translated papers have been made available by the group to the Editor of the Communications for possible publication. Persons wishing to join in this activity must agree to translate a specified number of pages of Russian text during a certain period and reproduce this for distribution among other members of the project. So far, the following papers have been translated:

1. Chapter VI, "Automatic Programming," from *Electronic Computing Machines*, A. I. Kitov, Moscow, 1956.

2. "On Some Methods of Approximate Calculation of the Characteristic Values and Characteristic Vectors of Positive Definite Matrices," M. A. Krosnoselskii, *Uspeki Mat. Nauk*, 1956.

3. "On Matrix Schemes," Yu. I. Ianov, *Doklady, AN USSR* 1957.

In addition, the following translation has been started: "The Theory of Algorithms," by A. A. Markov, Trudy, V. A. Steklov Institute, 1954.

The following papers, translated by Morris Friedman, Lincoln Laboratories, are available under certain conditions:

1. "On a Mathematical Symbolism Convenient for Performing Machine Calculations," L. V. Kantorovich, *Doklady, AN USSR*, 1957.

2. "On the Equivalence and Transformation of Programming Schemes," Yu. I. Ianov, *Doklady AN USSR*, 1957.

3. "Coding and Code Compression," L. M. Korolev, *Doklady, AN USSR*, 1957.

4. "On the Question of Automatic Programming in the Problem of Translation of One Language into Another," S. N. Razumovskii, *Doklady, AN USSR*, 1957.

Persons or organizations wishing to join in this mutual cooperative enterprise may write John W. Carr III, Associate Professor of Mathematics, University of Michigan, Ann Arbor. It is suggested that the "Russian-English Vocabulary" available from the American Mathematical Society, 80 Waterman Street, Providence, Rhode Island, is a good small mathematical glossary. It is hoped that one result of this mutual undertaking would be such a glossary in the fields of automatic programming and computer hardware.

News Items

"Contrasts in Computers," three full days of exhaustive debate of six controversial subjects in the fields of computer design and application, will be the program for the Western Joint Computer Conference May 6-8 at the Ambassador Hotel in Los Angeles. Co-sponsors are AIEE, IRE and ACM. Dr. Willis Ware of Rand is Chairman. Dr. Montgomery Phister of Thompson-Ramo-Wooldridge Products, Inc., in Los Angeles is Program Chairman. The discussion topics will include "Logical Design Methods," Dr. Gene Amdahl of Aeronutronic Systems, Inc., Chairman; "Active Elements for the Machine," Professor Ralph Meagher of the University of Illinois, Chairman; "Logical Circuitry for Transistor Computers," J. H. Felker of the Bell Telephone Laboratories in New Jersey, Chairman; "Tools and Techniques for Simulation," Wesley Melahn of Systems Development Corp. in Los Angeles, Chairman; "Command Structures," Dr. John W. Carr of the University of Michigan, Chairman; and "Very Large Files," Professor Alan J. Perlis of Carnegie Institute of Technology, Chairman. Dr. Cornelius Leonides of UCLA is Chairman of the contributed paper program.

A fourth day, May 9, will be sponsored by the Los Angeles Chapter of ACM and devoted to "Small Computers and Input/Output Equipment—A Report from the Manufacturers." Paul Armer of RAND will be General Chairman. The "reasonably firm" program announced by Fred Gruenberger of RAND, Program Chairman, will include reports on "Selfcheck—a New Common Language," "Character Reader for Bank Data Processor," "Datamatic 1000 Model 1400 Output System," "High Speed Computer Output Devices Utilizing the Character Beam Shaped Tube," "Data Translators," "The IBM 610 Auto-Point Computer," "The Recomp II Digital Computer," and "A Solid State Digital Control Computer." The tentative list of speakers shows representation from the following companies: General Electric, Intelligent Machines Research Corporation, Datamatic, Stromberg Carlson, Telemeter Magnetics, IBM, Autonetics, and Daystrom Systems.

Lockheed's Missile Systems Division, Palo Alto, California, has decided on a Remington Rand 1103A to augment its existing 1103A installation. This is the first step of Lockheed's plan to have two 1105 computers (1103A's with buffers) installed eventually. The 1105 computer is the type which will be installed at the Census Bureau; two or more 1105's will replace its Univacs.

As an aid in scientist recruitment, the National Bureau of Standards has announced successful results from its summer career program for students to become acquainted with a Government research laboratory. The program, inaugurated in 1948 and extended to the NBS Laboratories in Boulder, Colorado in 1956, has resulted in many valuable technical paper contributions and outstanding research by student trainees, junior professionals, and persons working part time during their study for higher degrees.

The first actual public demonstration of combined analog and digital simulation was made on January 8 when the Western Simulation Council, the DDA Council, Inc., and the Los Angeles Chapter of the ACM sponsored a joint half-day meeting at The Ramo-Wooldridge Corporation in Los Angeles to discuss "Inter-relationships of Analog and Digital Computers." The host, Irwin Pfeffer of Space Technology Laboratories, a division of The Ramo-Wooldridge Corporation, introduced the following speakers: Frank Curl of Jet Propulsion Laboratories in Pasadena for "Comparison of DDA, Analog, and Digital Computers," Dr. Rae Selfridge of NOTS in Corona, California, for "Simulation of a DDA on an IBM 704," Fred Lesh of Jet Propulsion Laboratories for "Simulation of an Active Analog Computer on a Datatron," Robert P. Adams of Space Technology Laboratories for "A Functional Description of the Epso Add-averter," and Michael Shumate of Space Technology Laboratories for "Techniques of Combined Analog-Digital Simulation."

Bendix Computer Division announced on January 16 that its 100th G-15 medium size general purpose computer rolled off the assembly line with special gold-plated exterior metal fittings in celebration. Dr. R. F. Hays accepted delivery for the Dow Chemical Company, Textile Fibers Department in Lee Hall, Virginia. This is the third G-15 in use in Dow's data reduction and other special applications in its fibre developmental operations. The G-15's are tied into actual test equipment with analog to digital devices. Development is in progress for G-15 process control of the actual fibre production.

The program for the 4th Annual Electronics Conference of the American Management Association on March 2-5, 1958 at the Statler Hotel in New York City has been announced. The subjects will include

Accounting with a Univac 120 and File Computer, Manufacturing Control, a Feasibility Study on a Datamatic 1000, Uses of the IBM 705, Bank Computer Applications, and Random Access Automatic Programming.

At their December meeting, members of the Los Angeles Management Division of the American Society of Mechanical Engineers heard Dr. Richard Bellman of the RAND Corporation in Santa Monica describe "Business Gaming in Management," a new technique for managerial training in making decisions. Given basic data and using a computer to keep score, the manager trainees test their ability to make decisions in the fields of production, marketing, research, development, and other management problems. A model situation involving a number of competing industries has been programmed for the IBM-650, and its successful operation has evoked interest.

The Professional Group on Electronic Computers and the Dallas, Texas Section of the Institute of Radio Engineers will sponsor the 1958 National Simulation Conference in Dallas, October 23-25, 1958. The technical program chairman, Mr. D. J. Simmons, Route 8, Box 447, Fort Worth, Texas is now soliciting technical papers on the following topics: analog and/or digital simulation of mathematical, physical, logistic, economic, chemical, etc., systems, advances in analog computer system and equipment design, and applications, and new methods of determining and improving the accuracy of analog solutions.

At the January meeting of the AIEE Power Division in Los Angeles, Dr. E. L. Harder of Westinghouse Electric Corporation described the 1957 developments in computers which were significant in computer utilization for machine and system design. He discussed the three stages of design optimizing as well as progress in programming, the use of automatic programming techniques, compilers, assembly programs, and interpretive programs.

A local SIAM Chapter has been formed in San Diego, California. About 40 persons have promised support for this chapter of the Society for Industrial and Applied Mathematics. The first meeting will be held February 6. For information contact Dr. Ward Sangren at General Atomic or Dr. William J. Schart at Convair.

Election results for new officers of the Digital Computers Association in Los Angeles were announced at its January 17 dinner meeting as follows: Eugene Jacobs of RAND, Chairman-Elect, Florence Anderson of NAA, Treasurer, and Don Breheim of Rocketdyne, Secretary. Fred Gruenberger of RAND was appointed Program Chairman. The program which followed was prepared by Dr. Don Wall, IBM representative at the Western Data Processing Center at UCLA, and Mr. Fred Gruenberger. They coordinated a series of short talks describing the evolution of "Computing in the Southern California Area." The amusing as well as interesting trials and tribulations of the early pioneers (even as far back as 1942) were described by Charles Davis, William Bell, Jack Strong, Cecil Hastings, Jr., (visiting from Hawaii) George Brown, Ernest Power, William Gunning, Paul Armer, Harley Tillett, Ben Ferber, Don Eckdahl, Lee Ohlinger, Walt Schleiser, Harold Sarkisian and Dan Sonheim. For those readers who are not familiar with the DCA, it is an unaffiliated local social-professional group of people active in the computing field, organized in 1952 as a "Chowder and Marching Society—with an incidental interest in computers." Some 200 individuals participate in the group activities, with an average attendance of 70 at its regular monthly dinner meetings.

Aero-Nutronic Systems, Inc., Ford Motor Company subsidiary, has acquired a 200 acre mesa on Irvine ranch, south of Newport Beach, California, as a permanent building site. Plans call for establishment of a multi-million dollar research and development center, specializing in aeronautics, electronics, materials, computers, physics, and nucleonics.

WESCON, the Los Angeles Section of IRE, and the West Coast Electronic Manufacturers Association (WCEMA) are now enjoying their new combined offices at 1435 South La Cienega Boulevard in Los Angeles.

Maurice Aegerter, formerly Assistant Supervisor of the Analysis Group at Douglas Aircraft in Santa Monica, California, has joined General Electric at Cincinnati.

Ted Gatto, formerly in the Management Sciences Department at The Ramo-Wooldridge Corporation in Los Angeles, is now busy as a Systems Analyst in the 704 Data Processing Group of Service Bureau Corporation.

Dr. H. R. J. Grosch, formerly with General Electric at Tempe, Arizona, has joined IBM in New York.

Dr. John W. Carr III of the University of Michigan appointed an "Ad Hoc Committee on Languages" consisting of Mr. John Backus, IBM, Mr. John Mauchley, Sperry-Rand, Mr. Robert Rich, Johns-Hopkins, Dr. Ruth Goodman, Westinghouse, Mr. Joe Wegstein, National Bureau of Standards, Professor Dean Arden or Professor Verzuh, MIT, (still to be decided) and Professor Alan Perlis as chairman, to meet at Carnegie Tech on Friday and Saturday, January 25-26 to attack the problems involved with standards and specifications of algebraic language. The outcome of this meeting will decide whether or not we should press the German-Swiss group (GAMM) for an invitation to meet with them in Switzerland to discuss an international set of standards."

Neal Dean, formerly with The Ramo-Wooldridge Corporation in Los Angeles has moved to New York as Director of Electronic Data Processing Systems for Booz-Allen and Hamilton.

Albert G. Swan has been appointed Central Regional Field Engineering Manager for the Electrodata Division of Burroughs Corporation, Pasadena, California.

Dr. T. C. Fry, formerly of Bell Telephone Laboratories, is now Vice-President of Remington Rand, Division of Sperry Rand Corporation, Norwalk, Connecticut.

Mr. Robert Schmidt, formerly with Sperry Rand in St. Paul has joined Telemeter Magnetics as East Coast Representative. He will establish its new office in Washington, D. C.

Dr. W. L. Gordon of the Defense Department is now senior engineer in the Systems Department of Datamatic in Newton Highlands, Massachusetts.

Albert Rosenthal is spending three months in Europe for the RAND Corporation.

Dr. Walter F. Bauer has been appointed as Director, Computation and Data Reduction Center, Space Technology Laboratories of The Ramo-Wooldridge Corporation in Los Angeles. The Center includes an 1130A computer, an IBM-704 and extensive data reduction equipment.

Jack Reynolds, formerly of Lockheed, California, Georgia, and Missiles Divisions, is now working for IBM in the San Francisco office.

Graham Tyson has joined Telemeter Magnetics in West Los Angeles as a Senior Applications Engineer. He will concentrate on the development of data translator equipment to provide communication between Univac and IBM machines as well as other special input-output adapters. He was previously head of the Special Electronic Digital Systems Development Group at Northrop and before that was associated with IBM.

Dr. Charles Swift of Convair in San Diego, California, reports that by July the San Diego area will have, at separate computing laboratories, two IBM 704's, one IBM 705, two IBM 605's and a Sperry Rand "Countess," a special computer about equivalent to an IBM 704 in size and cost. (Editor's note: It is interesting to note that the "Countess" computer was named for Ada Augusta, the Countess of Lovelace, competent mathematician and author of many technical papers in the middle of the 19th century. It was her interest, understanding and encouragement that helped Babbage through the troubled development of his analytical engine, the original hardware concept of our modern digital computers.)

Mr. Erwin Tomash, President, announced that on January 1, Telemeter Magnetics in West Los Angeles acquired the Ferromagnetic Production Division of International Telemeter Corporation. General management of the division will remain under the direction of Milton Rosenberg. Purpose of the move is to develop integrated capability to meet customer needs for ferrites, core memories, and data processing systems.

The Commercial Division of Librascope, Inc., the manufacturer of the LGP-30 Royal Precision Electronic Computer, has moved into new and larger quarters at 40 East Verdugo Avenue, Burbank, California. Concurrently, the 100th LGP-30 has just rolled off the assembly line.

Bendix Computer Division has opened a new and expanded office at 1000 Connecticut Ave., N. W., Washington, D. C. The new office will remain under the direction of Robert A. Sweet, Eastern Regional Manager.

Computer Control Company has also moved into a new building at 2511 Barry Ave., West Los Angeles. William V. Crowley, Western Regional Sales Manager for Alwac Corporation in Hawthorne, California, has announced the sale of an Alwac III-E medium sized digital computer to Safeway Store, Inc., in Oakland. This will be one of the first uses of computers by a chain store for marketing and sales analysis. The plans include later use for inventory and ordering control as well. Other recent Alwac III-E sales include the Cleveland Electric Illuminating Corporation for public utility billing; the Data Processing Corporation in Palo Alto, California, for service bureau use; the Liggett Drug Company in New York City, for inventory control; and Pharmaceutical, Inc., of Newark, New Jersey, for inventory control.

Cooperative Programming Groups

SHARE

On January 17 at the RAND Corporation in Santa Monica, California, the SHARE Executive Board met to plan the program for the 10th SHARE meeting to be held February 26-28 in Washington, D. C. The following people attended: Frank Wagner of NAA, Chairman; Ben Ferber of Convair, Vice Chairman; Herbert Bright of Westinghouse Bettis Plant, Secretary; Lee Amaya of Lockheed's California Division, Board Member; Paul Armer of RAND, Board Member; Walter Ramshaw of United Aircraft, Board Member; and Frank Engel of Westinghouse in East Pittsburgh, Past Chairman. At the February meeting approximately 40 per cent of the time will be devoted to Fortran matters, the establishment of standards for inter-communication in Fortran, analysis of comprehensive coding systems using Fortran as a basis, and discussion panels on user's experiences; another 40 per cent of the time will be used for similar work with respect to the IBM 709; and the remainder of the meeting will be devoted to IBM 704 SAP language discussions and miscellaneous administrative business.

The cooperative effort towards a comprehensive uniform system for the IBM 709 has reached a new high in such ventures. At this point, about five months before the first delivery, at least four man years has been spent by representatives of seven widely spread companies in designing and specifying the system in detail and at least twice that effort has been spent by IBM in programming, coding, and checking out the routines.

GUIDE

Chairman Ed Law, North American Aviation, in Downey, California, had nothing new to report at the press deadline for this issue, but the announcement of the new officers for GUIDE in the coming year will be immediately available following their election on January 30 at the forthcoming GUIDE meeting January 29-31, Hotel Biltmore, New York City.

USE

The next meeting will be held in Washington, D. C., March 26-28, 1958.

Bendix Computer Users

The Steering Committee of the Bendix Computer Users met in Chicago, January 20 to plan the next general meeting of its approximately 85 members.

DIGITAL COMPUTER NEWSLETTER

The purpose of this newsletter is to provide a medium for the interchange among interested persons of information concerning recent developments in various digital computer projects. Distribution is limited to government agencies, contractors, and contributors.

OFFICE OF NAVAL RESEARCH • MATHEMATICAL SCIENCES DIVISION

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Approved by
The Under Secretary of the Navy
20 August 1957

NAVEXOS P-645

COMPUTERS AND DATA PROCESSORS, NORTH AMERICA

COMPUTING LABORATORY—BALLISTIC RESEARCH LABORATORIES— ABERDEEN PROVING GROUND, MARYLAND

EDVAC. A Floating Point Arithmetic Unit has recently been added to the EDVAC System. The unit operates with the four-address code of the EDVAC, thus making it compatible with fixed point instructions.

The first ten bits of the floating point number word are used to express the exponent of 2, and its sign. The next 33 bits of the EDVAC 44 bit word are used to express the fractional part of the number. The resulting range for the fractional part is from $-(1-2^{-33})$ to $+(1-2^{-33})$. The exponential part ranges from 2^{+511} to 2^{-512} .

The unit will execute addition, subtraction, multiplication and division commands. At the completion of all operations, the unit will normalize the results, i.e., make the fractional part of the number always have the most significant bit.

The unit has error detection equipment for the following conditions:

1. Overflow, which occurs when the number exceeds 10^{47} .
2. Divisor is 0, which occurs when an attempt is made to divide a number by zero.
3. Number not normalized (except absolute zero). Although the unit will operate on some numbers which are not normalized, it is felt that it is important to know that an operand is not normalized, since some accuracy might be lost in the problem. The unit will halt the EDVAC when an unnormalized number is detected.

The average time required for operations are:

Addition and Subtraction	1956 Microseconds
Multiplication	1100 "
Division	2300 "

The design was accomplished by using plug in units with regeneration at every amplification stage. The units are similar to those used on the SEAC and MIDAC Systems.

Operating experience to the present time has proved the unit to be a very reliable piece of equipment.

RECOMP II—AUTONETICS—DOWNEY, CALIFORNIA

Autonetics, A Division of North American Aviation, Inc. has placed on the commercial market an all-transistor portable, general purpose digital computer, designated Recomp II. The basic features of the military version (Digital Computer Newsletter April 1957) have been retained. However, new and important changes have been incorporated. The computer is serial, single address, internally binary, has 18 arithmetic instructions, 21 logical and transfer instructions, and 9 input output instructions. Fixed and floating point instructions are built in. The magnetic disk memory capacity is 4096 words. Each word can contain 2 instructions or 40 binary bits including sign. Average access time to main memory is 8.7 milliseconds and to the high speed loops .91 milliseconds. Operation times, excluding access time are: .52 milliseconds for add-subtract, 10.4 milliseconds for multiply-divide, and 0.78 milliseconds for transfer control. Input to the computer is provided by the control panel, electric typewriter, or a photo-electric tape reader whose speed is 400 characters per second. The output can be in the form of a visual decimal display on the control panel, or typewritten copy of teletype paper tape. The cost of the basic computer is \$79,500.

BANKING AUTOMATION DEVELOPMENTS—BURROUGHS CORP.— PAOLI, PENNA.

The Bank Management Commission of the American Bankers Association has approved a recommendation for the adoption of magnetic ink character recognition as the common machine language most suitable for check handling. Data are imprinted in Arabic characters in almost conventional appearance style. Printing in magnetic ink overcomes the problems of obliteration and mutilation which harass optical character recognition systems and the close tolerance requirements of pattern systems and, at the same time, embraces the advantages of both systems. Moreover, the ABA Committee, the equipment manufacturers, and printers have decided that across the bottom of paper checks will appear a row of numbers, printed in magnetic ink, which will, electronically, tell the bookkeeping and proof departments of the future how to list, sort, post and otherwise account for the item.

In view of the above banking automation trend, Burrough's automation program embraces a variety of equipment. The system includes the Todd Magni-Chek Imprinter-Coder, the Sensimatic Proof and Distribution machine, the Burroughs Magni-Chek Amount Imprinter, the Burroughs Magni-Chek Transpose Document Sorter, the Sensitronic Bank Bookkeeping machines, the Auto Reader, and the Electr-Data DATATRON 220 Computer system.

The Todd Magni-Chek Imprinter prepares deposit accounting media in common language ink, ready for varying degrees of subsequent automatic processing. It enables the imprinting right on the bank premises of such data as account names and numbers, ABA transit and routing numbers, transaction codes and check serial numbers. An advantage of the Magni-Chek Imprinter-Coder is that not only can it imprint with conventional ink but it also possesses exclusive features which enable easy transition to the magnetic ink coding concepts.

Sensimatic Proof and Distribution machine is comprised of a Master Unit, a 27-pocket Sorting-Endorsing Unit, and a 27-tape Listing Unit with provisions for the attachment of a common language document inscribing unit for future automatic processing routines. There are facilities for by-product magnetic amount post-printing. A Selective Operation Control Panel makes possible almost unlimited programming. It provides automatic control, by classification, of proving, sorting, endorsing and float accumulation. Improved accuracy in the proof operation is afforded by simplified and enforced error correction procedures, including direct subtraction from the cross-footer and all registers. Enforced sorting assures that all documents arrive at their destination, and positive sorting protection assures accuracy of sorting. Should an item fail to reach the designated pocket, the machine locks.

The Magni-Chek Amount Printer, is designed to print in common language ink the amount of the item processed. The listing facility provides input for amount printing, and list and grand totals for proof purposes. The prototype of this device prints with a conventional inked ribbon, however, the production models will be adapted to magnetic ink printing.

The Magni-Chek Document Sorter achieves automatic, high-speed sorting of documents into desired sequences. Utilized with other automation devices, the Sorter furnishes read-sort input for a fully automated system. The first prototypes were based on fluorescent code and are being modified to magnetic ink common-language specifications.

The Sensitronic Bank Bookkeeping Machine is of special interest to the banking profession for it is the only device geared to verify the posting and printing of every item (checks and deposits) to the correct account. This printer and bookkeeping machine, in a rapid, true single posting run, eliminates the duplication of effort which traditionally has been necessary for attaining true verification, assuring each item being posted to the correct account. The Sensitronic is available with either single or dual printing sections. It functions electronically to perform the following operations: Alignment of forms at the proper printing position; correct pickups of old balances; and verification of postings to the correct account. In a single posting run the Sensitronic processes and completes an original-print combination

statement-and-ledger—with analysis data. It utilizes an advanced magnetic stripe technique to store the account number, item count, account balance with sign, line selection, alert notice and code checking information. This data is swiftly and electronically accessible.

The Auto Reader, in combination with one or more Sensitronics, electronically processes coded accounts for trial balances and balance transfers. The Auto Reader automatically feeds forms and reads balances electronically from magnetic stripe coded forms and transmits data to the Sensitronic for listing output and transfer to new statements.

The DATATRON 220 General Purpose Computer system, for banking applications, will use as input an automatically prepared punched paper tape representing previously processed coded data. This data will be in the form of random accounts, compared and updated by the computer with standing account tapes in sequenced order. Fully processed output includes updated balance tape, reportable items, printed journal ledgers and account analysis forms. Printed statements may be rendered in the form of daily or monthly statements, or abbreviated form statements.

MANIAC III—UNIVERSITY OF CHICAGO—CHICAGO, ILLINOIS

The University of Chicago has expanded its permanent research facilities with the organization of the Institute for Computer Research. The Institute became active at the beginning of the autumn term this year.

Dr. Nicholas Metropolis, who formerly led the computer research activities at the Los Alamos Scientific Laboratory, with MANIAC I and MANIAC II, has been appointed director of the Institute. Mr. Walter Orvedahl, also formerly of the Los Alamos Scientific Laboratory, is chief engineer. Mr. John McGiveran of the University of Chicago has joined the Institute as an assistant engineer.

The Institute has begun the construction of a digital computer which will be derived from the MANIAC types and which will probably be called MANIAC III.

DATAMATIC 1000—DATAMATIC—NEWTON HIGHLANDS, MASSACHUSETTS

First Installation. The first DATAmatic 1000 large scale, general purpose electronic data processing system has been delivered to Michigan Hospital Service, Detroit, Michigan, the nation's second largest Blue Cross-Blue Shield service. It will be used to maintain the subscriber records for 3½ million Michigan residents, keeping them up to date on a daily basis. Daily file activity averages 25,000 transactions including new subscribers, premium receipts, hospital entrance requests and a host of record changes, such as name or address, new dependents, different coverage and others.

The system will update the master record file, incorporating the entire 25,000 transactions in less than two hours of processing per day. Following the processing run, high speed DATAmatic output equipment is used to print a wide variety of forms and reports. This high processing speed allows ample time during single shift operation to handle various other applications such as billing, statistical compilation and payroll plus affording considerable capacity for growth.

In addition to this first installation, a number of systems have been ordered and will be installed in various locations in 1958 including Boston, Baltimore, Minneapolis, Los Angeles, Detroit and Parkersburg, West Virginia.

General Description of DATAmatic 1000. The DATAmatic 1000 is a product of DATAmatic, a Division of Minneapolis-Honeywell Regulator Company. The Division was originally formed by Honeywell and Raytheon Manufacturing Company to build and market the DATAmatic 1000, successor to RAYCOM, an early business data processing system. Honeywell subsequently acquired full ownership.

A general purpose system, the DATAmatic 1000 incorporates many new features and techniques specifically tailored to large volume business applications. One of the most important of these is the use of three-inch-wide magnetic tape containing 31 parallel recording channels. Information is recorded

and read horizontally along all 31 channels simultaneously in alternate blocks of fixed length. Inter-record blocks are used for starting and stopping as the tape moves from one end to the other. However, when the end of tape has been reached, it automatically reverses, and data is recorded in the blocks previously used for starting and stopping. This provides maximum utilization of tape capacity and eliminates rewinding since a tape that has been completely traversed, ends up back at the starting point.

High operational speeds and capacities are utilized through an extensive and flexible set of instructions. Several of these were designed specifically for faster, more efficient sorting and file maintenance. Moreover, these instructions may be automatically assembled into complete programs by the DATAmatic 1000 Automatic Business Compiler (ABC-1).

Model 1400 High Speed Output System. The Model 1400 High Speed Output System includes a special printer. Operating at a rate of 900 lines per minute, as used with the 1000, this printer will print up to 120 characters over a range of 160 possible print positions per line. Many forms, for example, can be printed side by side, effectively doubling the number of documents that can be printed in a given time period.

SELECTADATA—FRIDEN CO., INC.—SAN LEANDRO, CALIF.

The boundaries for the use of punched tape have been expanded by the development of the Friden Selectadata. The equipment can be described as providing simple facilities which enable new kinds of data processing to be performed in peripheral areas where documents and data originate.

The Selectadata is a completely self contained machine which includes a selective tape reader, and in certain models, a Manual Data Selector is also provided. The tape reader has the ability to skip through portions of a specially prepared punched tape at high speed until a pre-selected address code is read. Codes following this address code are then read at normal speed to control operation of the Flexowriter.

The Manual Data Selector, although included as an integral part of certain models, is actually a functionally independent feature. Its primary purpose is to supply semi-variable data to the Flexowriter and includes ten manually operated controls, each having eleven different control positions plus an off position. The various control positions select binary codes associated with the ten numeral characters plus the space code. In response to an automatic control from either the Flexowriter reader or the Selectadata reader, the ten codes selected by the manual controls are transmitted in proper order to automatically control operation of the Flexowriter. The Selector can be used to automatically insert a limited amount of numeric information both fast and accurately. A common example of such use is the automatic insertion of dates in document writing on the Flexowriter.

The tape reader operates with eight-channel punched tape where the normal character and function codes are exactly the same as in tapes used in the Flexowriter reader. The only special requirement in tapes is the insertion of address or classification codes at the beginning of each item or block of information, plus a single switching code inserted at the end of all items. Address or classification codes differ from normal character codes by always including a code hole in the eighth channel. This provides 127 different address codes. Master tapes can be prepared on the Flexowriter where special provisions are made for punching address codes, or by-product tapes can be produced during production operation of a Programmatic Flexowriter where address or classification codes are automatically inserted by non-print operation from a program tape or edge punched cards.

The Selectadata is provided with seven manual switches which can be operated in various combinations to select any one of the 127 different address codes. In reading the tape, all information preceded by other than the selected address code will be skipped at high speed. In certain models, provisions are made for either selecting address codes by the manual switches or for selecting the same address codes automatically from the Flexowriter reader.

Provisions have been made for two somewhat different types of operation by a duplex control switch arranged to determine which one of the two functions is to be performed upon reading the switch code

at the end of a selected item. When this duplex control switch is in its operated position, the switch code causes the reader to stop and transfers control to the Flexowriter reader. However, when the duplex control switch is in its normal position, the switch code retains control in the Selectadata reader and automatically initiates a high speed search operation for the next item preceded by the same address code. This control switch can then be used to provide either a single item searching operation with duplex control of the Flexowriter or can provide repeat searching operation for all items having the same address codes, thus enabling a new type of sorting and listing to be accomplished.

The automatic searching capabilities can be used in other ways for special applications. For example, compound searching is possible whereupon a stop code would be read so that a second search for a sub-classification would be manually initiated. These same sub-classification codes could be repeated within each of the different main classifications. This may in certain instances provide an automatic look-up system where a master tape can be used containing information which can have either a logical or illogical relation to two or more variables which are represented by the major and sub-classification codes.

The Selectadata will eventually be used with many types of Friden IDP machines, but it will first be available for use with various new models of the Flexowriter. Older models of the Flexowriter do not contain the necessary control features for use with the Selectadata, but new models being currently announced include provisions for cable connection to any one of various models of the Selectadata.

705-III—INTERNATIONAL BUSINESS MACHINES, CORP.—NEW YORK, N. Y.

The Data Processing Division of International Business Machines Corporation has announced the 705-III system, which will have greatly increased capabilities over the 705-I series.

One of the features of the new system is a completely transistorized magnetic tape unit, the IBM 729 Model III. Listed below are some comparative specifications with the earlier Model I.

	729-I	729-III	
Tape Density	200	534	Char. per lineal inch
Data Transfer Rate	15,000	60,000	Char. per second
Read-Write Speed	75	112½	Inches per second

The system also utilizes the new 767 Data Synchronizer which controls magnetic tape input and output so that the 705-III can read, compute, and write simultaneously. A single Data Synchronizer forms one transmission channel for a maximum of 10 tape units, and up to 6 synchronizers may be attached for simultaneous and independent operation.

A 40,000 character magnetic core storage is provided as a basic 705-III memory, and this can be enlarged to 80,000.

MONROBOT IX—MONROE CALCULATING MACHINE CO.— MORRIS PLAINS, NEW JERSEY

The MONROBOT IX is the first low priced, desk size, all electronic business computer. This office computer is designed to handle both the simple and the complex billing operations encountered in large and small companies. However, its flexible control-program unit will permit its use for many other general accounting functions.

The command structure is unusually flexible for a machine of its price range (approximately \$11,000). It offers 15 separate operations including all basic arithmetic operations.

The machine operates under control of line programs selected by the operator. A line program determines format control, print-out of alphanumeric data, automatic spacing, tabulating, carriage return and line feed, and decimal point.

The input output device is a standard IBM electric typewriter. All necessary operating controls are included on the input output unit. Any format may be followed, and also the typewriter may be used independently.

The system has a total of approximately 50 vacuum tubes, 1000 diodes, and requires 750 watts of power.

Automatic Features: Calculation with any fraction or fractions without reference to decimal equivalents; Printout of repetitive alphabetic and numeric detail; Printout of daily totals accumulated from invoice details; Decimal point alignment of printout; Consecutive numbering and dating; Tabulation; Roundoff; Constant percentage calculations, such as sales tax, discount, etc.; Calculation of group or chain discounts without reference to decimal equivalents.

Specifications.

Arithmetic Operations:	Addition	Subtraction	*Multiplication **Division
Commands:	Halt Input Input & multiply Print Store	Transfer Divide Add Subtract Shift right	Shift left Space Tab Carriage return/line feed Decimal point

Storage: Magnetic drum with 14 registers; each register 62 binary bits in length (18 decimal digits). Registers may be subdivided to provide a greater number of smaller ones. Example: Could be programmed to furnish 42 six digit registers.

Program Capacity: 8 programs with 52 instructions per program (via plugboard). 6 instructions per program can be modified by depression of a program selection key.

Programmed Alphabetic Output: Automatic print out of any fixed, repetitive letters, symbols, words, or sentences.

*Multiplier must be introduced via keyboard.

**Quotient is outputted and must be re-entered for further manipulation.

SEAC—NATIONAL BUREAU OF STANDARDS—WASHINGTON, D. C.

SEAC Experiments in Pattern Recognition. A scanning system SADIE (SEAC Automatic Digital Input Eye) has been added to SEAC as a research facility for use in character and pattern recognition experiments. This equipment combines automatic scanning input, the processing power of a general purpose digital computer and an output display, making it possible for SEAC to accept automatically, under program control, an image from a photograph into its memory and to reproduce a copy of that image either as it was read in or as it has been modified by subsequent processing. Computer programs include various experiments in performing logical operations on pictorial and graphic information for such purposes as counting and recognition of key objects in a photograph, drawing or map, simulation of automatic character recognition devices, and the automatic encoding of graphic information.

Recent Modifications. SEAC's preparation to handle data searching, pictorial recognition and real time simulation in conjunction with the laboratory's analog equipment, necessitated a number of modifications in its internal units and additions in peripheral hardware.

In input output equipment, SEAC has added 1 Flexowriter, 1 high-speed punch, 1 Potter perforated tape reader, 8 Ampex magnetic tape units, 1 picture scanner, SADIE (SEAC's) Automatic Digital Input Eye), 1 input serializer with 352 possible inputs, and 1 output staticizer which scans a preselected portion of the mercury memory continuously. Considerable speed gain is accomplished in the 8 multi-channel Ampex units by the feature of individual positioning control concurrent with computation, a 6 channel buffer, and recording data blocks in variable sizes.

Other modifications include an expansion of the memory to 2048 words and installation of two new orders, a SHIFT and an EQUALITY order.

NAVAL AIR TEST CENTER—U. S. NAVAL AIR STATION— PATUXENT RIVER, MARYLAND

The capabilities of the Electronic Computer Unit of the Naval Air Test Center (NATC) have been increased by the installation in October of an automatic Floating Point Control Unit and a second Data-reader for use with the Datatron Computer. Following are the operating statistics for the Datatron installation at the NATC for the three month period ending 31 October 1957:

	<i>Analysis of Computer Time</i>					
	August		September		October	
	Hours	%	Hours	%	Hours	%
Production	147.3	89.3	72.4	48.3	202.2	117.2
Code Checking	41.4	25.1	38.2	25.5	23.9	13.9
Idle	3.2	1.9	5.3	3.5	1.0	0.6
Down Time	2.9	1.8	34.1	22.7	8.5	4.9
Total	194.8	118.1	150.0	100.0	235.6	136.6

The first hour of each work day is utilized for preventive maintenance. The remainder of the work day, 7½ hours, is used as the basis for the computation of the operating statistics. Percentages in excess of 100 arise when the computer is used for production or code checking after the regular workday. Idle time includes time lost during the basic 7½ hour day due to power failure or air conditioning malfunction. The large amount of down time during September occurred during the installation of the Floating Point Control Unit.

FLAC I AND II—RCA SERVICE COMPANY, INC.— PATRICK AIR FORCE BASE, FLORIDA

FLAC I. Operating record for the period 22 August to 20 November 1957:

<i>Category</i>	<i>No. of Hours</i>	<i>Percent of Manned Hrs.</i>
Data Running	954.0	60.0
Code Checking	273.3	17.18
Analysis	7.3	.46
Library Maintenance	20.3	1.27
Power Failure	34.7	2.18
Idle Time	1.4	.08
Preventive Maintenance	189.3	11.90
Unscheduled Maintenance	110.2	6.93
Total Manned Hours for Period	1590.5	100.00

FLAC I continues to be scheduled 24 hours each day for five days each week processing missile test data.

FLAC II. The Central Computer, console, power supplies, memory and a part of the programmed input output equipment have been installed for FLAC II. De-bugging and engineering evaluation has been in progress since approximately 15 October 1957.

On 5 November 1957, the first production data was reduced on the computer. One 8 hour shift per day is now available for data processing. Engineering evaluations and the addition of various peripheral equipments will continue for the next several months. With the advent of FLAC II there now exists at the Air Force Missile Test Center identical and duplicate computing facilities for data processing.

TRANSAC S-2000—PHILCO CORP.—PHILADELPHIA, PENN.

The Philco TRANSAC Newsletter, November 1957, lists revised specification and information on their S-2000 computing system. Copies of the newsletter may be obtained from the Government and Industrial Division, 4700 Wissahickon Avenue, Philadelphia, Pennsylvania.

UDOPT AND MOBIDIC—SYLVANIA ELECTRIC PRODUCTS INC.,— WALTHAM, MASS.

The *UDOPT* computer now being developed by Sylvania for the U. S. Naval Training Device Center is a special purpose, high speed, digital computer designed to accomplish the real time control of operational aircraft flight trainers. The original systems, logical design, and preliminary circuit design of the computer system were done by the staff of the Moore School of Electrical Engineering, University of Pennsylvania, under contract with the U. S. Navy.

In the flight trainer application the computer will replace most of the operational control functions currently being accomplished with analog computers. The digital computer is well suited for this application because of its inherent flexibility in the simulation of the flight characteristics of different types of aircraft. This can be done by changing the equations of flight, requiring only a change in the computer program. The characteristics that make the *UDOPT* computer satisfactory for this specific control problem also make it suitable for other applications of real time control. Inherently, it is a large scale, general purpose computer, but under the present program only special input output equipment is provided.

The computer is a parallel-sequential, single address, binary, synchronous, digital computer. Numbers are represented in the computer by 22 binary digits—20 digits representing absolute magnitude, one digit for the sign, and one digit for the parity check. Instructions are represented by 20 binary digits—12 digits representing the operand address, seven digits for the order type (including one spare digit), and one digit for the parity check. The master clock has a frequency of 1.2 megacycles and includes five phases. The circuitry is of the dynamic type (SEAC, DYSEAC) with low level diode gating (pulses are of 5 volts magnitude).

A unique feature of the *UDOPT* is the parallel-sequential mode of operation. In this mode the number memory operates in parallel, but the information is presented to the arithmetic unit sequentially. That is, the arithmetic unit is parallel, with each stage delayed one phase from the preceding one. In this way the arithmetic operation times are made independent of generated carry digits.

Another special feature is the incorporation of two independent, random access, magnetic core memories. The use of two memories, one exclusively for instructions and one exclusively for numbers, permits the use of an extremely fast instruction cycle since the instruction memory can be used to decode an instruction at the same time that the number memory presents the operand from the preceding instruction. Thus, each instruction requires only one access to each memory. The capacity of each memory is 4096 words, and each has a read-write time of 5 microseconds.

The computer input system, except for the initial memory loading by a card reader, consists mainly of analog inputs from controls located in the trainer. The analog inputs are converted to digital form at the point of generation by code wheel converters. There are also discrete inputs from toggle switches in the trainer and at the instructor's console.

The computer output system is almost the inverse of the input system. The analog outputs are converted in a digital to analog converter and are multiplexed out to locations specified by the computer. These outputs operate the trainer instruments. The discrete outputs are used to light indicators located in the trainer and at the console.

1. Arithmetic Operation Times (including memory access time):

Add	5 microseconds
Subtract	5 "
Multiply	10 "
Divide	105 "

2. Number of Instructions: 27

MOBIDIC is a high speed, mobile digital computer being developed for the U. S. Army Signal Engineering Laboratories. It is intended for field use by the Army and its design is characterized by a high degree of flexibility allowing it to be adapted to many classes of data processing and computational problems. The major characteristics are:

Mode of Operation	Fixed point, parallel, internally binary, single address, synchronous.	
Word Length	37 bits plus 1 parity bit.	
Arithmetic Representation	Sign plus magnitude.	
Memory Size	4096 words expandable to 28,672 words in units of 4096 words.	
Memory Access Time	8 microseconds for complete read-write cycle.	
Order Repertoire	Eleven arithmetic orders Eight transfer orders Twenty-one logical orders Nine input-output orders.	
Operating Speed (including memory access)	Addition	16 microseconds
	Subtraction	16 "
	Multiplication	86 "
	Division	88 "
Input-Output Speed	Input-output is simultaneous with computation and proceeds at the rate of the input-output device; no interruption of computation occurs unless both require simultaneous memory access, then, computation is delayed by one memory cycle.	
Internal Addressable Registers	10 (expandable to 32)	
Index Registers	4 (expandable to 7)	

Input-Output Devices

Up to 64 input-output devices (magnetic tape units, paper tape units, line printers, typewriters, card handling units, etc.) with up to 8 operating simultaneously. Also capable of accepting and delivering full computer words at a rate up to 125,000 words per second.

The first computer will be installed in a 26-foot standard Army van which will include air conditioning equipment for the comfort of the operators. Transistors are used throughout. Delivery will be in 1959.

COMPUTING CENTERS

AIR FORCE ARMAMENT CENTER—ARDC—EGLIN AFB, FLORIDA

Acceptance tests have been completed on the newly installed *Charactron-Manual Intervention System* for the Univac Scientific 1103, and the equipment is being incorporated in the Digital Flight Test Instrumentation and Data Reduction System for B58 Fire Control Evaluation. Magnetic tape recordings of digitized data are being played directly into the Univac Scientific Computer and such final answers as hit probabilities are the output. Graphical output, and program monitor and control are the functions of the Charactron-Manual Intervention equipment.

The *Teledata System* of leased wire communications between Eglin Air Force Base, Florida; Kirtland Air Force Base, New Mexico; and the Ballistic Test Facility, Pasadena, California, has been accepted and is now in use.

A data processing center called *TELEMAG*, for the handling of analog and digital magnetic tape and telemetered data, has been initiated. First construction and installation will take place in January 1958. *TELEMAG* will, through existing equipment and an EPSCO Datrac analog-digital converter, have direct connections with the Univac Scientific 1103 Computer. Editing, "quick look" facilities and analog recording will be featured, and the system will accommodate FM, PDM and PAM telemetry.

WESTERN DATA PROCESSING CENTER—UNIV. OF CALIFORNIA— LOS ANGELES, CALIF.

The University of California and IBM announced jointly recently that the machine to be furnished to the Western Data Processing Center will be a type 709, instead of a type 705, as previously announced (Digital Computer Newsletter July 1957).

COMPUTING CENTER—CALIFORNIA INSTITUTE OF TECHNOLOGY— PASADENA, CALIF.

The California Institute of Technology recently reorganized and expanded its machine computing activities with the conversion of its analysis laboratory. It has just moved into a new building housing these facilities, which include a Datatron with floating point arithmetic and two tape units, a large Direct Analogy Electric Analog Computer developed by the Institute, a Librascope LGP-30 and an IBM 705.

The activities of the Computing Center comprise three general areas: 1. Basic research in applied mathematics and computer development, 2. Student training through a core of basic courses and student research, and 3. Provision for a service facility for all campus research.

Current research in the field of numerical analysis includes a study of random numbers used in digital

computation, flutter analysis by digital computers, solution of polynomial equations, and three-dimensional Fourier synthesis for such applications as crystal structure analysis in physical chemistry. Research in machine design and evaluation includes such subjects as micro-programming in the design of medium sized computers, research in externally programmed computers, application of computers to supersonic and transonic flutter analysis of delta and low aspect ratio wings, application of digital and analog computers to nuclear reactor design and other engineering problems involving diffusion equations.

A number of important additions have been made to the technical staff of the Computing Center, whose principal members now include Dr. G. D. McCann, Dr. C. H. Wilts, Dr. Joel Franklin, Dr. Robert Nathan, Mr. C. V. Ray and Mr. Kendrick Hebert.

RAYDAC— U. S. NAVAL AIR MISSILE TEST CENTER—POINT MUGU, CALIF.

New input equipment is now being used with RAYDAC. Programs and constants are read directly from paper tape at 200 characters per second. IBM cards are used for data input and for corrections to programs, at rates up to 240 cards per minute. Telemetry data is processed from digital storage tape at rates up to 1,000 samples per second.

A high-speed output system is expected to be in operation by 30 April 1958. This system will use an IBM 407 tabulator, IBM 523 card punch and a Talley digital plotter, for either on line or off line output operations.

ELECTRON COMPUTER BRANCH (CODE 280)—BUREAU OF SHIPS— WASHINGTON, D. C.

Applied Mathematics Laboratory, DTMB. The most significant problems solved on the UNIVAC systems at the Applied Mathematics Laboratory, David Taylor Model Basin in the first half of the calendar year are:

1. Development of routines for the generation of contour maps of neutron fluxes both for the automatic point plotter and the line printer.
2. Calculation of the stresses, moments, and displacements of a quarter-torus seal used in one design of pressurized water reactors.
3. Calculations relating to the analysis and prediction of submarine motion.
4. Reduction of tactical data acquired on full-scale ship trials.
5. Calculations relating to the formulation of design specifications for a pair of contrarotating propellers, such as are used on torpedoes and certain submarines.
6. Numerical evaluation of a two-dimensional integral involving six parameters, relating to the accurate location of a mine whose approximate position was previously known.
7. Calculation and automatic point plotting of a set of charts based on azimuthal equidistant projection, to be used in the solution of problems relating to the propagation of radio waves over long distances.
8. Simultaneous solution of a pair of first-order differential equations occurring in a theoretical analysis of the pressure buildup in a vented magazine containing a burning propellant. The results were used in the design of storage magazines for rocket motors.

Significant *engineering modifications* were made in the Unityper Model 1 at the Laboratory to enable it to be used as a paper tape to magnetic tape converter. This modification involved the design, installation, and testing of conversion circuitry necessary to make the input from a punched paper tape reader acceptable to the Unityper in place of its keyboard signals.

LARC. Several changes have been made in the LARC system as now on order by the Bureau of Ships for use at David Taylor Model Basin. The system now consists of the following components:

- 30,000 words high speed memory
- One computer unit
- One input output processor
- Alphameric high speed on line printer
- Four tape read/write synchronizers
- Two drum read synchronizers
- One drum write synchronizer
- 12 drums
- 16 UNISERVO II
- 72 A & B registers
- Flexowriter and paper tape input/output unit
- One operating console
- One engineering console

In view of the high speed and large memory capabilities of the LARC system, the concept of programming the LARC is still under study. Whether all the changes as enumerated above will provide the best balance in machine capabilities, will not be known until some years after the computer is installed and operating. Certainly the concepts in computer programming as utilized in present day machines will have to be radically changed. Automatic programming is being developed, as an aid to rapid solution of large problems.

COMPUTER CENTER—NAVY ELECTRONICS LABORATORY— SAN DIEGO, CALIFORNIA

Improvements in the physical organization of existing computers and the installation of a Datatron 205 were both accomplished at NEL during October 1957. The center now occupies the entire top deck of wing 1, building 33—some 3,400 square feet of air conditioned floor space, exclusive of programmer offices.

The center now includes the EASE, a 30 channel general purpose analog, the REAC, a 40 channel, 8 servo general purpose analog, the MADDIDA, an 80 channel digital differential analyzer, a TELE-READER, TELECORDEX and OSCAR for digitization and automatic data plotting, as well as the DATATRON with its peripheral equipment for card, paper tape and magnetic tape input and output, tabulating and collating.

To supplement the work of the assigned programmers, a series of programming courses have been held to instruct scientific personnel in open shop use of the computers. In operation two weeks, the installation has already analyzed data for underwater sound studies, for atmospheric signal propagation, and obtained results in probability detection problems.

NAVAL ORDNANCE COMPUTER CENTER—U. S. NAVAL PROVING GROUND—DAHLGREN, VIRGINIA

The 16,000 character-per-second *cathode ray tube printer*, which is being developed by the Stromberg-Carlson Corporation for on line use with the Naval Ordnance Research Calculator (NORC) is now scheduled for delivery in January, and is expected to be operating by April 1958. Features of the printer include alphanumeric characters, elaborate editing under program control, and point-plotting in rectangular coordinates. Of the two 35mm cameras which record the characters, one contains equipment for processing and projecting the film within 8 seconds after exposure. Auxiliary apparatus for making paper prints is also being installed.

A Naval Proving Ground Technical Memorandum (No. K-10/57) has been published giving a preliminary description of the *Universal Data Transcriber* (UDT), a stored program device being designed to make possible rapid off line communication between NORC and various input and output devices, as well as other computers.

Computing Services. Interested organizations and activities with defense contracts are reminded that some NORC computing time is expected to be available in 1958 at a cost of less than \$200 per hour. Programming, mathematical research and analysis, and consulting services are also available at cost. Further information may be obtained from Director, Computation and Exterior Ballistics Laboratory, U. S. Naval Proving Ground, Dahlgren, Virginia.

COMPUTERS, OVERSEAS

ERMETH—EIDG. TECHNISCHE HOCHSCHULE—ZURICH, SWITZERLAND

At the Swiss Federal Institute of Technology, the electronic computer ERMETH is now in operation under the direction of Professor E. Stiefel. The computer has floating decimal arithmetic (3 decimals for the exponent, 11 decimals for the mantissa), but can compute as well with fixed point arithmetic (14 decimal digits). The storage is a 10,000 word magnetic drum with 6000 rpm, but only 4400 storage positions are in operation at the present time. Input and output goes via keyboard, electric typewriter and punch card equipment. As special features we have 9 Index registers (B-line) for the simplification of address-modification and the Q-sign which is a mark to label the last number of a sequence of numbers and allows to avoid counting operations in certain induction loops. Moreover the computation of elementary functions like

$$\sqrt{x}, e^x, \ln x, \sin x, \cos x, \operatorname{arctg} x$$

is carried out upon a simple shift of control (unconditional call) to fixed programs.

Programming for the ERMETH is very simple and can be done by beginners; in fact a large proportion of the total computing time is used by outsiders who do their own programming.

At present the following library programs are available:

- LR-Transformation
- Gauss Elimination
- Development into Tschebyscheff series
- Gill's method to integrate Differential Equations
- Quotient-Difference-Algorithm

For more details see:

1. Mitteilungen aus dem Institut für angewandte Mathematik. "Die mathematischen Grundlagen für die Organisation der elektronischen Rechenmaschine der Eidg. Techn. Hochschule" by J. R. Stock (Birkhäuser Verlag, Basel/1956).

2. Scientia Electrica. "Die elektronischen und magnetischen Schaltungen der ERMETH" by A. Schai (FABAG—Fachschriftenverlag und Buchdruckerei, Stauffacherquai, Zurich/1957).

COMPUTING MACHINE LABORATORY—UNIVERSITY OF MANCHESTER— MANCHESTER, ENGLAND

Unsteady Flow Past a Circular Cylinder, by Professor R. B. Payne. To investigate the cross flow round a yawed projectile travelling at high speed through the air, Helmholtz's vorticity equation has been integrated for the incompressible flow in two dimensions. This parabolic partial integro-differential equation with three independent variables is solved by the method previously developed by the author. For the starting flow an interesting variation in the drag is encountered, the drag coefficient subsiding to the known value for the steady flow.

A Multi-track Magnetostatic Head, by Professor D. B. G. Edwards. An unconventional magnetic tape reading head, capable of reading digital information from either stationary or moving magnetic tape, is being used as the basis of several convenient auxiliary computer equipments at Manchester University.

One of these equipments is a Computer Output System, which records computer output on magnetic tape at any rate up to a maximum of 1000 characters per second. A character corresponds to a line of 5 or 6 binary digits written in parallel tracks across the tape. The information may be recorded over a wide range of tape speeds (including zero), but is laid down on the tape at the uniform density of 100 binary digits per linear inch. The information is read and checked character by character as it is recorded. Erroneous information is appropriately marked and re-recorded until correct.

The system utilizes 8 reading heads arranged in a block of 8 tracks across standard $\frac{1}{2}$ -inch magnetic tape. In each track, and separated by .005" from the associated read head, is the "write" head.

The reading head operates on the principal of reluctance modulation. The reluctance of the head itself is varied at a definite rate causing a variation in the flux linkage between the head and the magnetic tape. The resultant changes in flux produce a read "signal" which provides a measure of the leakage flux from the tape and its polarity. This signal is present even if the tape is stationary. This type of head detects any type of magnetic field including a d.c. field, and hence it has been made minute in order to intercept as little stray field as possible.

The resultant head can be used without screening under laboratory conditions since it has a signal to earth's field ratio of about 15:1.

Immediately after information is recorded by the "write" heads of the block, it passes under the associated read head. No further information is recorded on the tape until a read signal occurs. The spacing of the information is thus dependent only on the separation between the read and write heads, and is independent of tape speed.

A Tape Editing Equipment, using a block of reading heads, is used to convert the information from the output tape to the printed page. This equipment operates with the tape moving at speeds slow enough for direct printing by mechanical teleprinters. There is, of course, no loss of read signal.

Other equipments envisaged are a Magnetic Tape Input Equipment, and a Magnetic Tape Preparation Equipment.

MAILUFTERL—DER TECHNISCHEN HOCHSCHULE—VIENNA, AUSTRIA

*MAILUFTERL is the Transistorized Digital Computer of the Institut fuer Niederfrequenztechnik, University of Technology, Vienna, Austria. The model is being developed at the Institute for purposes of the Institute's research. The material is a gift from Austrian and foreign industrial companies. Approximately 3000 low frequency transistors (Philips OC71 and OC76) and 5000 germanium diodes are the switching and amplifying components; no tubes or relays are used.

MAILUFTERL is a fixed point serial decimal machine using the Stibitz-code. Floating point can be programmed. Logical operations on alpha-numerical data can be performed.

Organization. The word length is 48 bits or 10 decimal digits plus one sign digit and one operational digit. Negative numbers are represented by the true complement. The single address system is used. Instruction word: 4 decimal digits for address, 2 decimal digits for index, 16 functional bits, one decimal digit for conditions, and one operational digit. The free combination of the 16 functional digits (2^{16} possibilities) provides maximum flexibility in programming. The operational digit distinguishes between numbers and instructions and between marked and unmarked words; it also detects one bit errors in the memory.

Control Unit. A Stibitz-adder makes automatic address modifications (index operations, address substitutions or both). A register stores the return instruction during subroutines.

Arithmetic Unit. It includes 3 registers, one normal accumulator, one accumulator for special purposes and one storage register, all with operational checking flip-flops. Multiplication and division are done by subroutines on the drum. 5 logical operations are binary (change from Stibitz-zero to 0000).

Memory. 1. Magnetic drum: 7" diameter bronze cylinder of 16" length; 3000 r.p.m. AGFA coat. 200 tracks of 50 words each, addresses numbered from 0000 to 9999.

2. Immediate access core-matrix for 50 words (corresponding to one track), addresses numbered from 0050 to 0099 (extension to 9999 possible; distinction between drum and other addresses by a functional bit; addresses 0000 to 0049 give access to registers etc. and to input and output devices).

Input Output. 1. Tape readers and teletype writers.

2. Manual switch input for two words, optical display for one word; any address can be read out or written in manually.

Speed. Basic frequency 132 kc/s, pulse duration 4 microseconds.
Word duration 0.4 milliseconds.
Instruction (reading and executing) 0.8 milliseconds.
Multiplication program (2 ten digit numbers) 26 milliseconds.

DC power consumption. 400 watts.

Time scale. Development of circuits started in Spring 1956.
Construction started May 1957.
Construction will be finished in December 1957.

*"MAILUFTERL" is a friendly Viennese spring-time wind. The name indicates the distance from "whirl-winds" and "typhoons."

WEIZAC—THE WEIZMANN INSTITUTE OF SCIENCE—REHOVOTH, ISRAEL

WEIZAC, the computer at the Weizmann Institute, has completed its second year of operation. For the first year, the memory was a home made drum; during the second year, the ferrite-core memory manufactured by Telemeter Magnetics, Inc. of Los Angeles, was in operation, allowing the high-speed of the arithmetic organ to be fully utilized. Measured operation times for major orders are as follows:

Addition or Subtraction	50	microsecs.	
Multiplication	750	"	average
Division	850	"	
Store	25	"	

these times include memory access.

Computation time was allocated to the various users one week in advance, additional shifts being added by request. A summary of hours of operation is given below.

A Teletype high speed paper punch was put in operation in October 1956 and has been working since. A magnetic tape system has been developed for intermediate speed, high capacity storage, which is now undergoing its final tests.

Month	Code Checking		Production		Total Computation Time		Idle Time		Scheduled Engineering and Development		Unscheduled Breakdowns	
	Hrs.	Mins.	Hrs.	Mins.	Hrs.	Mins.	Hrs.	Mins.	Hrs.	Mins.	Hrs.	Mins.
Oct. 56	72	30	51	—	123	30	—	—	50	—	34	25
Nov.	42	40	61	15	103	55	8	15	46	—	52	20
Dec.	37	—	87	—	124	—	7	45	38	50	33	—
Jan. 57	52	—	60	20	112	20	35	45	50	40	12	10
Feb.	44	35	79	30	124	05	8	30	65	50	34	10
March	50	—	141	30	191	30	6	35	54	15	23	40
April	68	—	76	30	144	30	8	25	53	40	4	20
May	79	30	132	—	211	30	4	10	45	—	12	15
June	103	45	224	45	328	30	5	15	38	45	6	15
July	83	—	356	25	439	25	6	45	57	05	26	55
Aug.	81	—	265	45	346	45	10	15	50	30	14	45
Sept.	83	—	224	—	307	—	6	55	48	10	32	30
	797	—	1760	—	2257	—	107	45	607	45	286	45

COMPONENTS

HANDWRITTEN CHARACTER READER—BELL TELEPHONE LABORATORIES— NEW YORK, N. Y.

Bell Telephone Laboratories has announced a device that can read handwritten numerals or identify numerals as they are being written. With some modifications the equipment could be used to read handwritten letters. The machine may eventually become a valuable addition to telephone offices, and it could be important in any situation where it is necessary to write and identify large quantities of numerals.

The machine recognizes numbers as they are being written on a specially-prepared writing surface using a metal stylus. Two dots, one above the other, are used as reference points. Seven sensitized lines extend radially from these two dots. Numerals are recognized by the machine, depending on which lines are crossed. To recognize previously written numerals, such as those on a long distance ticket, it is necessary to write with a pencil containing a conductive lead. The ticket is then inserted in the machine into a special slot under a plate that has seven sensitized lines. The machine then uses the same principle for recognizing numerals already written as it does for the ones written on the machine with the stylus. That is, it determines which sensitized lines have been crossed. This information could be transferred to an accounting machine, computer or other data processing device.

In order that written numerals may be read with a minimum possibility of error, mild restrictions must be placed on their size and form. The constraints consist of two vertically-aligned dots, around which the numerals must be formed. Three radius vectors extend out from each of these dots, and a seventh joins the two. Numerals are then sensed by determining which of these radius vectors are crossed.

Information as to which vectors have been crossed is transmitted to a translator, which contains transistorized logic circuits. Since each numeral has a corresponding set of crossings which is unique, the translator needs only to be able to distinguish each of the sets in order to produce a different output

for each numeral. The outputs are employed in the utilization circuit to illuminate a number, operate a teletypewriter, feed the information to a computer, or perform any other desired operation.

To recognize written numerals, a specially-prepared plate is employed on which each radius vector appears as a closely-spaced, insulated parallel set of conductors. The numerals must be written with a conductive pencil on a sheet of paper or a card. When this writing is superimposed on the printed plate and properly oriented, the appropriate set of conductors are shorted out. The information thus obtained is fed to and analyzed by the translator and logic circuit, which determines the proper number and transmits the identification to the utilization circuit.

To recognize numerals as they are being written, a writing surface is provided on which there are two guide dots and in which seven radius vectors, made of conducting material, are embedded in plastic. The writing is done with a metal stylus on the writing surface. Whenever a conductor is crossed, the information is fed to the translator and logic circuit. As necessary crossings are made for a particular numeral, the translator again sends the proper information to the utilization circuit. To clear the system for the start of the next numeral, a conducting plate is touched by the stylus.

The technique has been extended to permit the identification of handwritten letters. To properly read such letters, it appears that a four-dot constraining system with 12 radius vectors is necessary. However, to identify letters as they are being written is somewhat simpler, since advantage can be taken of the order in which the radius vectors are crossed. By utilizing this additional information, it is possible to identify either letters or numbers as they are written by employing the 2-dot constraining system used for numerals.

ROLLAFOLD—BENSON-LEHNER CORP.—WEST LOS ANGELES, CALIF.

The Rollafold is a portable folding machine for producing neat, accordion folds in a long strip or roll of paper, such as the chart from an oscillograph or pen and ink recorder.

Some of the advantages which result from folding long rolls of paper into an accordion fold are:

1. They are more easily handled for analysis. Unrolling and re-rolling are eliminated. Any part of the record is readily available for examination—as easy as opening a book.

2. They may be stored in conventional folders and file cabinets. Thus they may be kept with other information concerning the test.

3. They may be bound into reports and transferred or mailed in conventional envelopes. An operator can fold charts five to ten times faster with a Rollafold than by hand. Neatness and accuracy of fold spacing are far superior. Operation is simple and requires no special training.

The body of the machine is supported by four legs and a tubular frame in a manner which provides space for the folded chart to accumulate. All moving parts are enclosed, and the construction is of the highest quality. Sintered bronze and sealed anti-friction bearings are used throughout. All gears and drive arms are pinned to their shafts to preclude the possibility of slippage. The feed roller is surfaced with neoprene and ground to size. It may be readily removed, if cleaning becomes necessary. The machine is quiet in operation and is designed for many years of daily usage.

Overall Size	18 in. w. x 20 in. l. x 21 in. h.
Net Weight	45 pounds (approximately)
Fold Spacing	Continuously adjustable—6.5 to 12.5 inches
Fold Rate	One fold per second (approximately)
Power Required	115 vac, 60 cps, 1.7 amp (maximum)
Chart Size, Model B	Up to 13½ inches wide Any core diameter Up to 6 inches outside diameter
Model Variations	Larger chart size available on special orders
Price, Model B	\$1,275.00

NEW STORAGE UNITS AND DATA TRANSLATORS— TELEMETER MAGNETICS, INC.—LOS ANGELES, CALIF.

144 Series Magnetic Core Storage Units. These units have capacity for 144 characters. The 144 BQ-8 stores 8-bit characters, and the 144 BQ-4 stores 4-bit characters. Both units are identical in all other respects. The bits of each character are loaded in parallel. Characters are loaded and unloaded in a sequential pattern—i.e., the first character loaded is the first one unloaded, and loading and unloading are performed in a nonsynchronous manner. The two operations may be interlaced in any order desired, and there is no time delay in changing from loading to unloading. Characters may be loaded or unloaded at any rate up to one complete character every 14 microseconds.

The 144 series use transistors and other solid state elements exclusively—no vacuum tubes are required—giving these units a very low down time factor. Control and logic circuitry are mounted on plug in etched boards for ease of maintenance. All driving circuitry and a complete power supply are contained with the unit in a single package no larger than a portable phonograph.

Input pulse requirements are:

One	5 volts
Zero	-5 volts
Load Sync	10 volts
Unload Sync	10 volts

Output pulses available:

One	5 volts
Zero	-5 volts

THE DATA TRANSLATOR. "Common Language" is a concept of which so much has been said and so little has been done. However, Telemeter Magnetics, Inc. has done something to provide compatibility among computer systems of the various manufactures. The Data Translator System has been evolved for this purpose and can accomplish the following conversions:

IBM 704	↔	Univac Scientific
IBM 705	↔	Univac I & II
IBM 650	↔	Univac File Computer
Datatron 205	↔	IBM 650, IBM 705, Univac I & II

Special input/output conversions such as- Magnetic tape to printer, punched card to magnetic tape, magnetic tape to punched paper tape, punched card to paper tape.

The Data Translator System uses magnetic core storage and is completely transistorized providing very low down time equipment. Logic is contained on etched board plug-ins for ease of maintenance.

MISCELLANEOUS

COMPUTER USAGE COMPANY, INC.—NEW YORK, N. Y.

The Computer Usage Company, 18 East 41st Street, New York 17, N. Y. entered its third fiscal year of operation 1 October. As of December, CUC had in process or completed major business and scientific assignments for 26 different companies throughout the United States.

Business applications developed and in operation include inventory control, linear programming, file maintenance, and scheduling.

Scientific and technical services are offered in the general areas of engineering and applied physics. The organization provides personnel for analysis, programming, and testing at selected computing facilities. Work has been successfully completed on such widely varying assignments as nuclear reactor design, oil reservoir exploitation, heat transfer, orbits of an artificial satellite, and highway design.

Two major reactor design codes have been developed. CURE: a generalized two-space-dimension multigroup coding for the IBM 704. Sponsored by the AEC through KAPL, CURE has been released and is currently in use by more than twelve reactor design organizations. BORE: a two-dimensional evaluation of neutron diffusion equations and heat balance equations in a boiling reactor, developed for the Atomic Power Equipment Department of the General Electric Company.

Unit merchandising control on the IBM 650 was developed for Hartfield Stores, Inc., a chain of more than forty women's apparel shops. This system completed 20 months of continuous successful operation on 1 January, 1958.

Present staff numbers 45 full time employees, with experience in the IBM Types 701, 702, 704, 705, 650, RAMAC, and NORC; UNIVAC Systems; DATATRON; and BIZMAC. Since application development, rather than repetitive processing of data, is the primary function of CUC, it does not operate its own machine facility. Instead, programs are developed for the machine most suitable to the client.

CONTRIBUTIONS FOR DIGITAL COMPUTER NEWSLETTER

The Office of Naval Research welcomes contributions to the NEWSLETTER. Your contributions will assist in improving the contents of this newsletter, and in making it an even better medium of exchange of information, between government laboratories, academic institutions, and industry. It is hoped that the readers will participate to an even greater extent than in the past in transmitting technical material and suggestions to this Office for future issues. Because of limited time and personnel, it is often impossible for the editor to acknowledge individually all material which has been sent to this Office for publication.

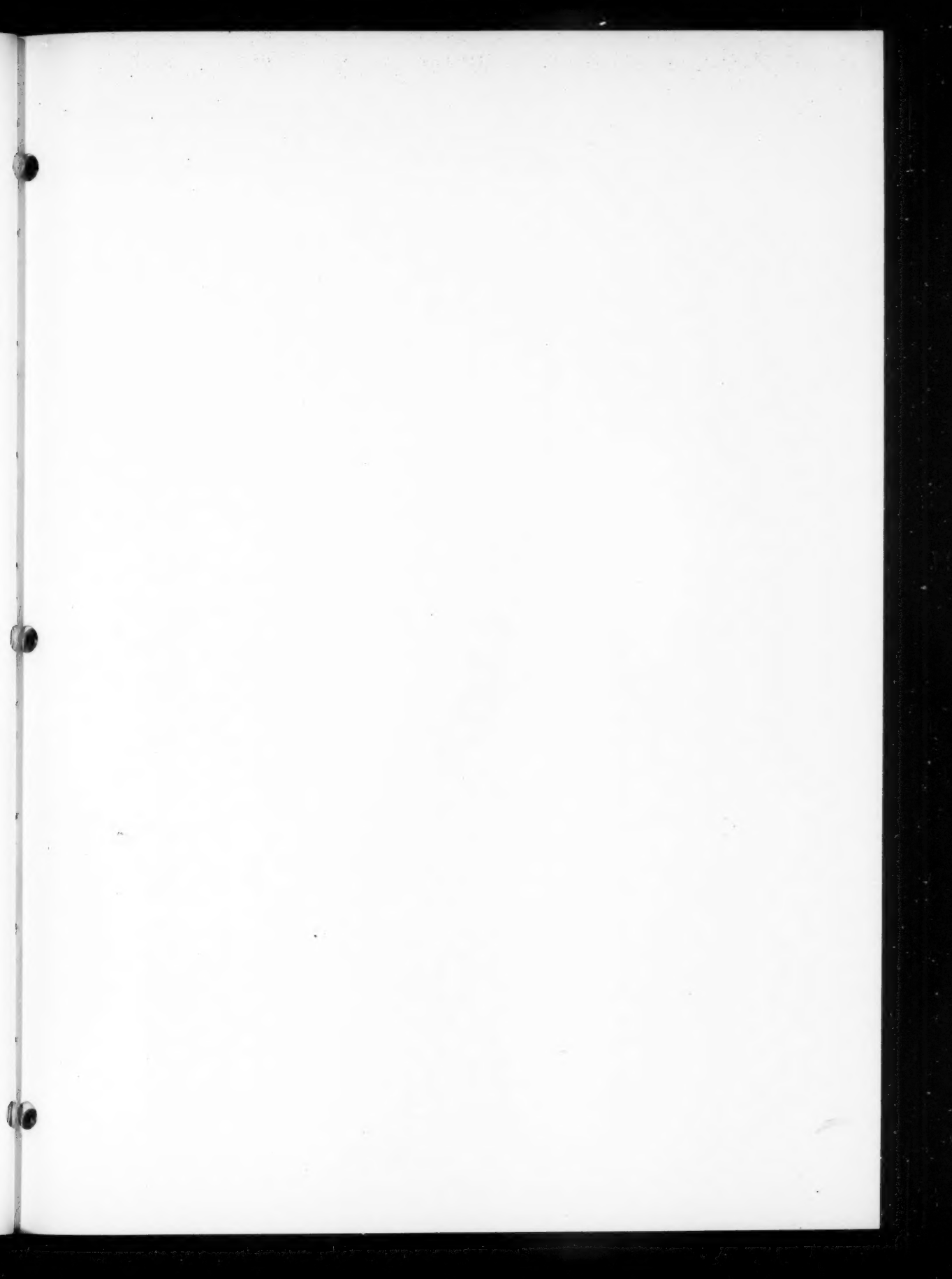
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